

Application of Building Information Modeling In Singapore MRT T207 Project

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This paper introduces Singapore's Building Information Modeling (BIM), the adoption of BIM in Singapore MRT T207 Project, summarized the benefits of BIM applications in T207 and the focus of future BIM implementation in T207.

1. INTRODUCTION

Building Information Modeling (BIM) is the process of generating and managing building and/or construction data during its life cycle. Typically it uses three-dimensional, real-time, dynamic building modeling software to increase productivity in building design and construction. A 2013 survey found 76% of firms in Singapore using BIM, and this is predicted to rise to 96% by 2015. Singapore's BIM agenda is led by the Building and Construction Authority (BCA) which introduced a BIM Roadmap (Figure 1) in 2010 and launched BIM Fund (Figure 1), part of Construction Productivity and Capability Fund, in June 2010 to defray costs of training, consultancy, software and hardware.

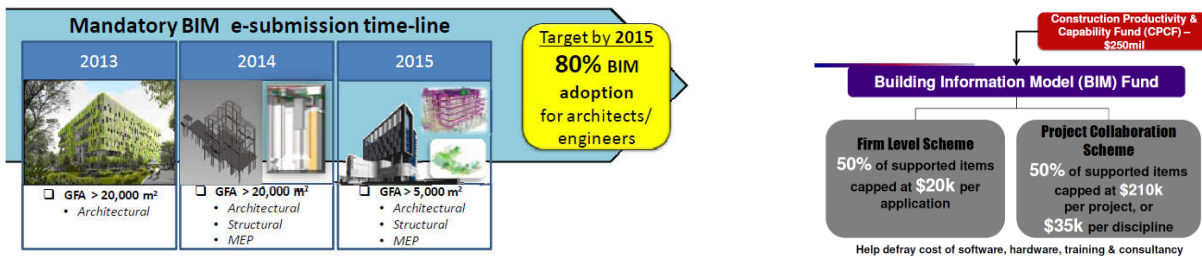


Fig. 1 Singapore BIM Roadmap and BIM Fund

Singapore is a world leader in the digitisation and automation of the issuing of building permits called CORENET E-Submission System (Figure 2) to streamline the process for regulatory building code permission. The World's First BIM E-submission System via Construction Real Estate NETWORK (CORENET) was launched in 2010 to accept architectural BIM 3D models (Figure 2).

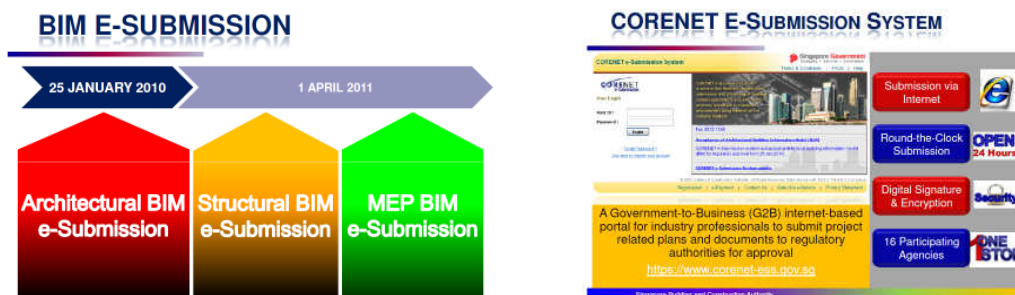


Fig. 2 Singapore CORENET E-Submission System

2. SINGAPORE MRT T207 PROJECT

Although Public Sector Agencies in Singapore are tasked to lead the industry's use of BIM in Singapore, Contract T207 is not obligated in adopting BIM. However, Shimizu realized the importance and the abundance of benefits of BIM applications and decided to implement BIM in Contract T207. Contract T207 awarded in January 2015 is a unique project of MRT Thomson East Coast Line which involves construction of two pairs of bored tunnels commencing from launching shafts from Contract T206 and T20 towards Escape Shaft 2 next to the RTS building as shown in Figure 3.

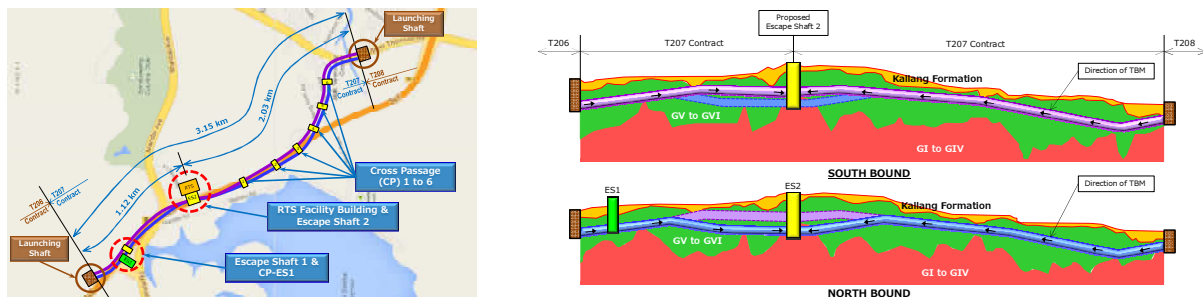


Fig. 3 General Layout and Geotechnical Profile of T207 Project

Keyword: Singapore MRT, Building Information Modeling, CORENET, E-Submission, REVIT, Autodesk Civil 3D
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3. APPLICATION OF BIM IN SINGAPORE MRT T207 PROJECT

Autodesk REVIT is widely used in the BIM application in T207 project as early as tender stage, mostly in the virtual construction sequence simulation to study and adopt the most practical construction method as shown in Figure 4.

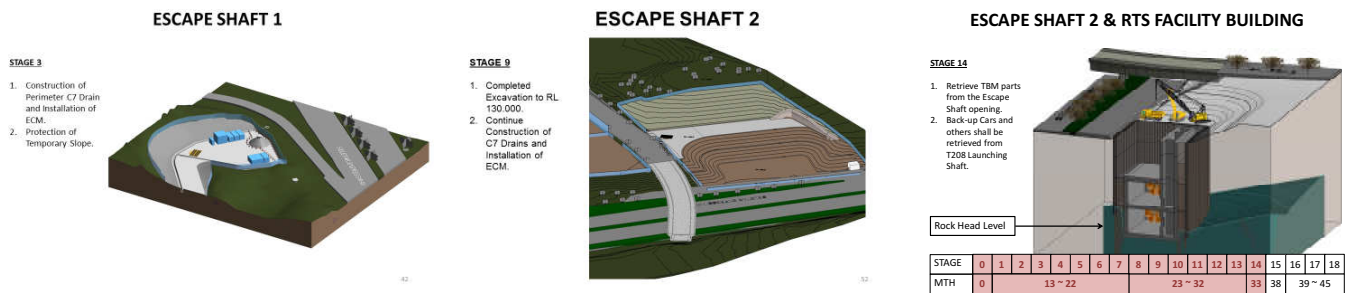


Fig. 4 Virtual Construction Sequence at Escape Shaft (ES) 1 and 2

BIM is also used to verify the quantity surveyed especially in calculating the excavation volume (cut and fill) of soil as shown in Figure 5. Other BIM application includes shopdrawing production and rebar fabrication as shown in Figure 6.

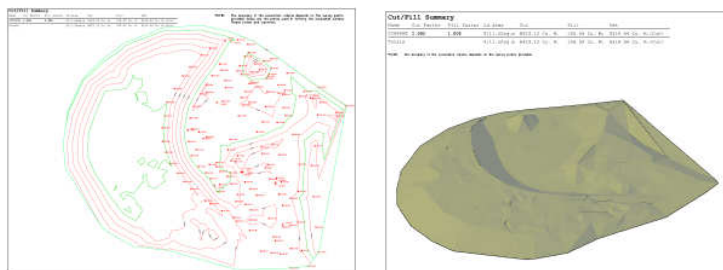


Fig. 5 Excavation Volume (Cut and Fill) of soil at Escape Shaft 1

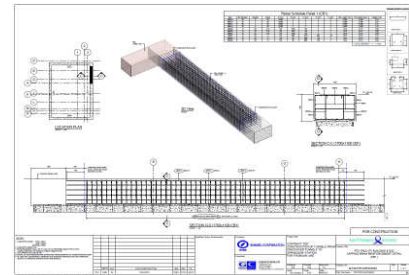


Fig. 6 Shopdrawing and Bar Bending Schedule

Due to the variation of rock head at ES2, BIM is introduced for reviewing complicated details of temporary structures during shaft excavation. Geotechnical Module of Autodesk Civil 3D 2015 is used in simulating the soil profile surrounding ES2 using the data obtained from the additional bored holes conducted. The 3D rock surface is then exported to Autodesk REVIT to simulate the temporary works at Escape Shaft 2. Autodesk REVIT is used to model the temporary works required at Escape Shaft 2, such as CBP wall, shotcrete of the rock surface, king posts and temporary steel strutting as illustrated in Figure 7. By introducing BIM model, designer can review their design detailing and confirm constructability by virtual simulation. Construction team can use to the 3D model for easy understanding and minimize discrepancies and mistakes during construction.

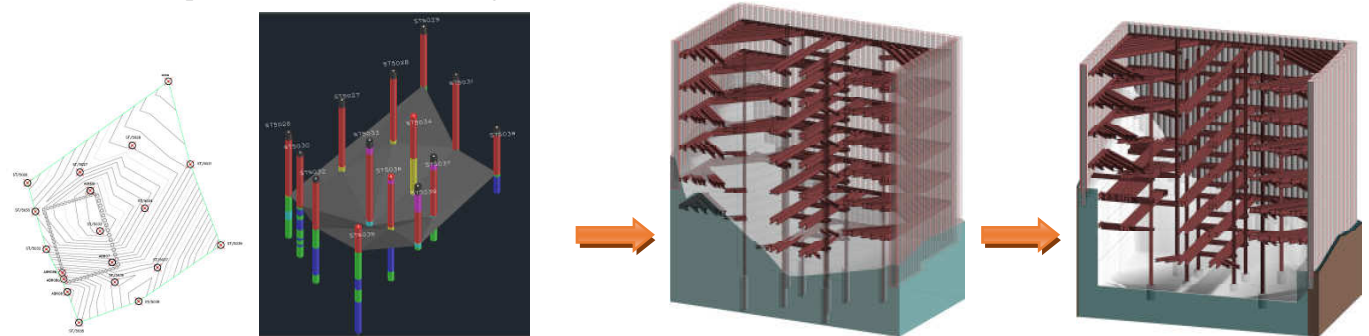


Fig. 7 Coordination and Refining the Temporary Work Design using Autodesk Civil 3D and REVIT

4. CONCLUSIONS

With the advancement in the development of BIM tools such as Autodesk Civil 3D and REVIT, virtual construction and visualization of soil profile and site has been made easy. Therefore, reduction in site modifications and adjustment due to unforeseen soil condition can be reduced, improved design efficiency due to easy retrieval and interpretation of information, improved labour productivity, increase speed of delivery and ultimately resulting in cost reduction.

Documentation of the crack development and crack behavior of tunnel segments together with soil information in the TBM tunneling process as well as NATM tunnel in the cross passages will be the focus in the next stage of BIM implementation in T207 Project.

REFERENCES

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